Shippensburg Pump Company, Inc.

BOILER FEED • CONDENSATE • DEAERATOR • VACUUM

One Schwenk Drive
P.O. Box 279
Shippensburg, PA 17257-0279

Phone: 717-532-7321
Fax: 717-532-7704
www.shipcopumps.com

March 17, 2006

Re: Misconceptions About Operating a Deaerator.

***Misconception*: Deaerators Can Run Effectively If Shut Off Regularly?**
Deaerators operate most effectively if they run twenty-four hours per day, seven days a week. If deaerators are turned off every weekend or every night, oxygen re-enters the water, when the water remaining in the deaerator receiver cools below the saturation point, and then is distributed throughout the boiler system on each start-up cycle – causing premature failure due to corrosion and defeating the whole purpose of having a deaerator in the first place.

Also, it typically takes between 3-5 hours to bring the water temperature in the deaerator up to the saturation point (i.e., boiling point) depending on how cold and how much water is in the receiver. This will result in non-deaerated water being pumped for 3-5 hours throughout the steam system. Therefore, in applications where the system is turned off daily or weekly, a boiler feed with preheat would be the more practical and economical solution.

***Recommendation*: Deaerators Should Run Continuously. Otherwise Consider a Boiler Feed Unit With Preheat.**

***Misconception*: Deaerators Can Achieve Their Performance Rating Even If Water Temperature Is *Not* Maintained At Saturation Point?**
If the water in the deaerator is not at saturation point (i.e., boiling point), then the deaerator is not operating at maximum effectiveness. Therefore, the deaerator will not be able to achieve its rated level of deaeration of either .03 or .005 cubic centimeters of oxygen per liter of feed water. For example, on atmospheric deaerators, the water temperature must be maintained at 212° F (at sea level). On Shipco® pressurized deaerators, the water temperature is maintained at 227° F based on 5 psig of operating pressure inside the deaerator.

***Recommendation*: Water Temperature Must Be Maintained at Boiling Point.**

<u>Misconception</u>: Can Perform Effectively If "Swings" Occur Of The Amount of Water and Water Temperature Entering the Deaerator?

Amount of Water Entering Deaerator:

On *two-tank systems* (i.e., deaerator and standalone surge tank), the two units must function like a *two-compartment* (i.e., one tank with two separate chambers) system. Makeup is always added into the surge tank (not directly into the deaerator) and blended with the return water. The transfer pumps on the surge tank must run continuously – pumping the water first into the modulating make-up valve (i.e., the make-up into the deaerator) before it enters deaerator. City make-up water is always added into either a surge tank or a surge-chamber, depending on the system design, when returns are present.

Why is this important? Consider the example of a pot of boiling water on the stove. What happens if a cup of cool water is dumped into the pot of boiling water? The water in the pot stops boiling for a period of time. As we noted in item B above, when the water is not boiling, it is not deaerating. To be able to add water into the pot while maintaining the water at boiling point, water must be added gradually in small increments.

The underlying concept of Deaerator/Surge Tank combinations is based on the same principle as the pot of boiling water. Deaerators must be kept at boiling point to remove the oxygen to the rated level of.03 or .005 cc/l. If any sudden, large surges of water are added to the deaerator, the water will stop boiling. If the water is not boiling, the oxygen is not being removed. Therefore, a modulating transfer valve on the deaerator gradually feeds the blended water from the surge into the deaerator, preventing a large "slug" of water from being added to the deaerator that would cause the water temperature to drop below boiling point.

Temperature Water Feeding Deaerator:

In addition to amount of water entering a deaerator, the temperature of the water entering the deaerator is also a critical factor for the deaerator to achieve is rated performance. The heat source of the deaerator (i.e., the preheat tube controlled by a steam regulator) is designed to match the expected input of water pumped into the deaerator through a modulating makeup valve from the surge tank.

When colder city make-up water (e.g., 50^{o} F) is added into the system through the surge tank, that has water temperature around 150^{o} F, the temperature of the water in the surge tank will drop by only a few degrees – perhaps down to 140^{o} F or 145^{o} F. However, if the city make-up water was added directly to the deaerator, rather than the surge tank, then the temperature of the water in the deaerator will initially drop below boiling point. While the steam regulator will respond to the drop in temperature by opening the regulator to allow more steam into the preheat tube to restore the temperature to boiling point, there never-the-less will be a delay until the water in the deaerator is restored to boiling point. This swing in temperature, caused by the delay, will result in non-deaerated water being pumped to the boiler.

In addition, for deaerator manufacturers that do no inject steam below the water, there is no means to reheat the water to remove the oxygen present. Therefore, approximately 10 minutes of non-deaerated water (i.e., since deaerators are typically sized for 10 minutes of storage) will be pumped to the boiler. This is why Shipco® provides preheat both above and below the water line on most deaerator designs. For more information, see article "Why inject steam below water line of the storage section on most deaerator style?" under "Technical Articles" section of website (www.shipcopumps.com).

Recommendation[s]:

- ***City make-up water must be added into the surge tank and then pumped into a modulating transfer valve by the continuously running transfer pump.***
- ***Injecting steam below the water line is a major advantage on deaerator designs.***

Shipco® Marketing and Sales Department